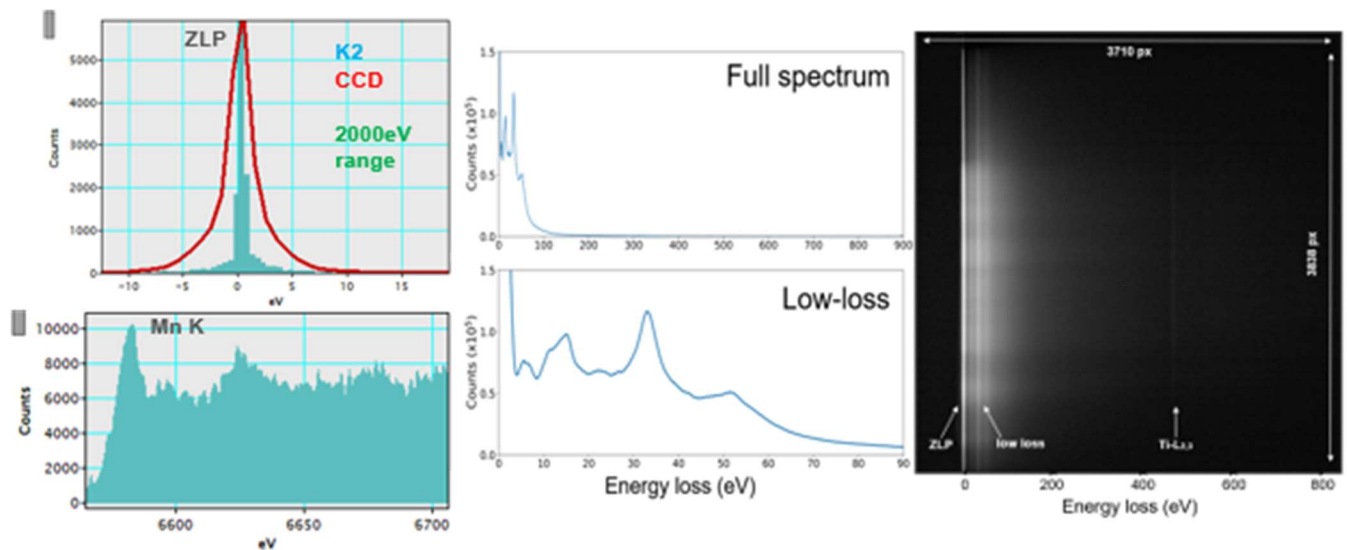


## Advanced Direct Detection EELS Workshop – FELMI Institute, University of Graz, Graz, Austria 25<sup>th</sup> - 26<sup>th</sup> September 2019



Indirect cameras (IDC) for electron detection convert high energy incident electrons to photons which, through a fiber optic network or lens, are coupled to a camera, typically a CCD. This indirect detection method inherently limits the camera's point spread function (PSF) and detection quantum efficiency (DQE). Over the last decade, radiation tolerant CMOS active pixel sensors, which directly image high energy incident electrons, have been developed with much improved PSF and DQE in comparison to conventional IDCs. Such direct detection cameras, here abbreviated DDCs, have been successfully utilized in cryo-TEM and in situ TEM for both imaging and diffraction. Owing to this big improvement in the PSF, EELS spectra can be acquired over large fields of view while maintaining the energy resolution unchanged. Such DDCs detectors can be operated in counting mode where each electron that falls onto a pixel in the camera can be distinguished and the charge isolated. The result is a dramatic increase in the resolution and reduction of all the additional sources of noise typically those related to the fiber optic, gain and dark contributions. The shot noise is now the only source of noise present and the implication in the acquisition of EELS spectra is that chemical analysis becomes more straightforward and in the case of low signal even possible. These improvements offered by the DDC have a wide range of applications including efficient and low-dose spectrum imaging, trace element detection and analysis, and time-resolved EELS.

The Gatan Advanced Direct Detection EELS workshop at the University of Graz will begin with an introduction lecture of direct detection technology for low dose imaging and EELS data acquisition. Following the lecture, participants will

have the opportunity to participate in comprehensive hands-on training on advanced EELS applications enabled by direct detection.

Topics to be covered during the workshop:

- Direct Detection Technology
- Counting electrons and advantages for imaging and EELS spectroscopy
- Instruments noise free EELS analysis
- Fast STEM EELS analysis
- Low-dose EELS analysis
- Chemical analysis
- Ultra-High-Energy edges acquisition.
- Direct Detection practical sessions – looking at attendee's TEM specimens. For those interested in bringing a specimen please contact us to give some preliminary TEM specimen descriptions.

The workshop will be organized in two identical sessions, the 1st one on 25<sup>th</sup>, the 2<sup>nd</sup> one on 26<sup>th</sup> of September.

For registration and information about the workshop, please contact Dr Andreas Kastenmueller:  
akastenmueller@gatan.com

